



Multi-Level Sensory Interpretation and Adaptation in a Mobile Cube

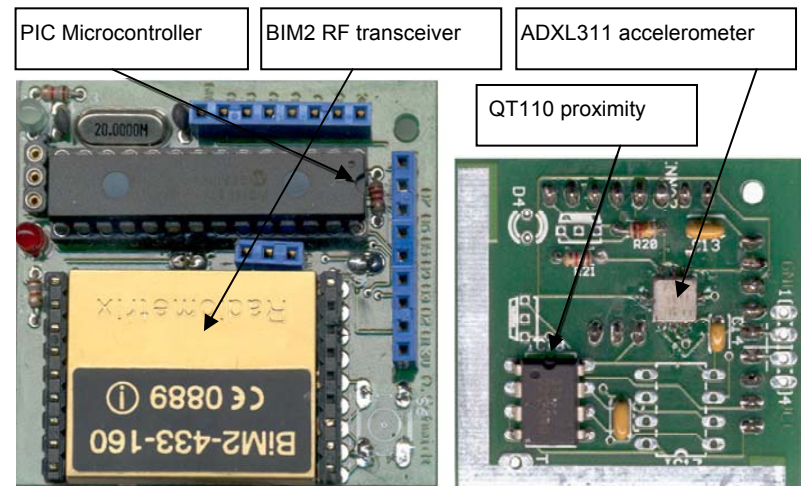
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Outline

- Focusing on the microcontroller level
 - smaller in size, less complex platform
 - cheaper in price, consumes less power
- Exploiting ambiguity in sensor signals:
 - specific example: accelerometer
- Goals :
 - making the signal processing better/easier
 - Getting the best of simple sensors

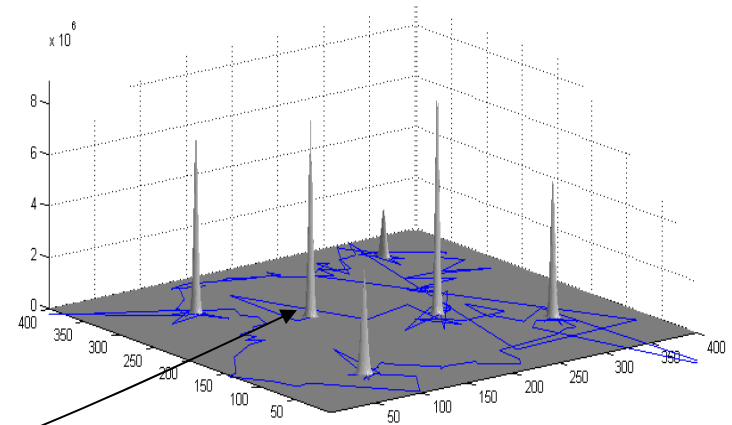
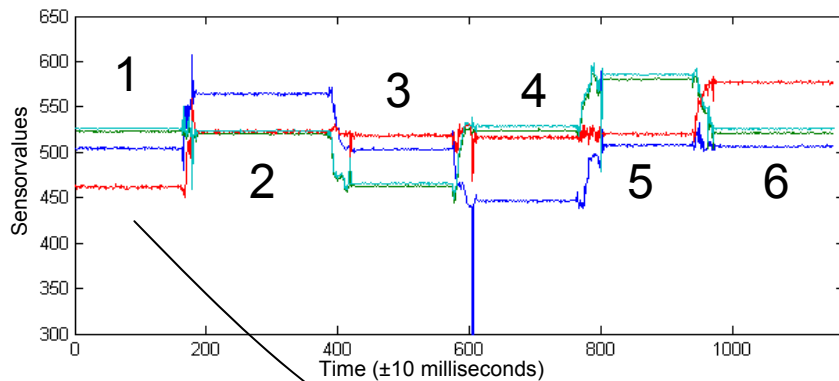
Hardware

- Based on Smart-Its core board: provides processing power and communication
- Sensor board with 2 acceleration sensors placed at right angles to each other, used to determine orientation
- Touch/proximity sensor included to enable power saving features



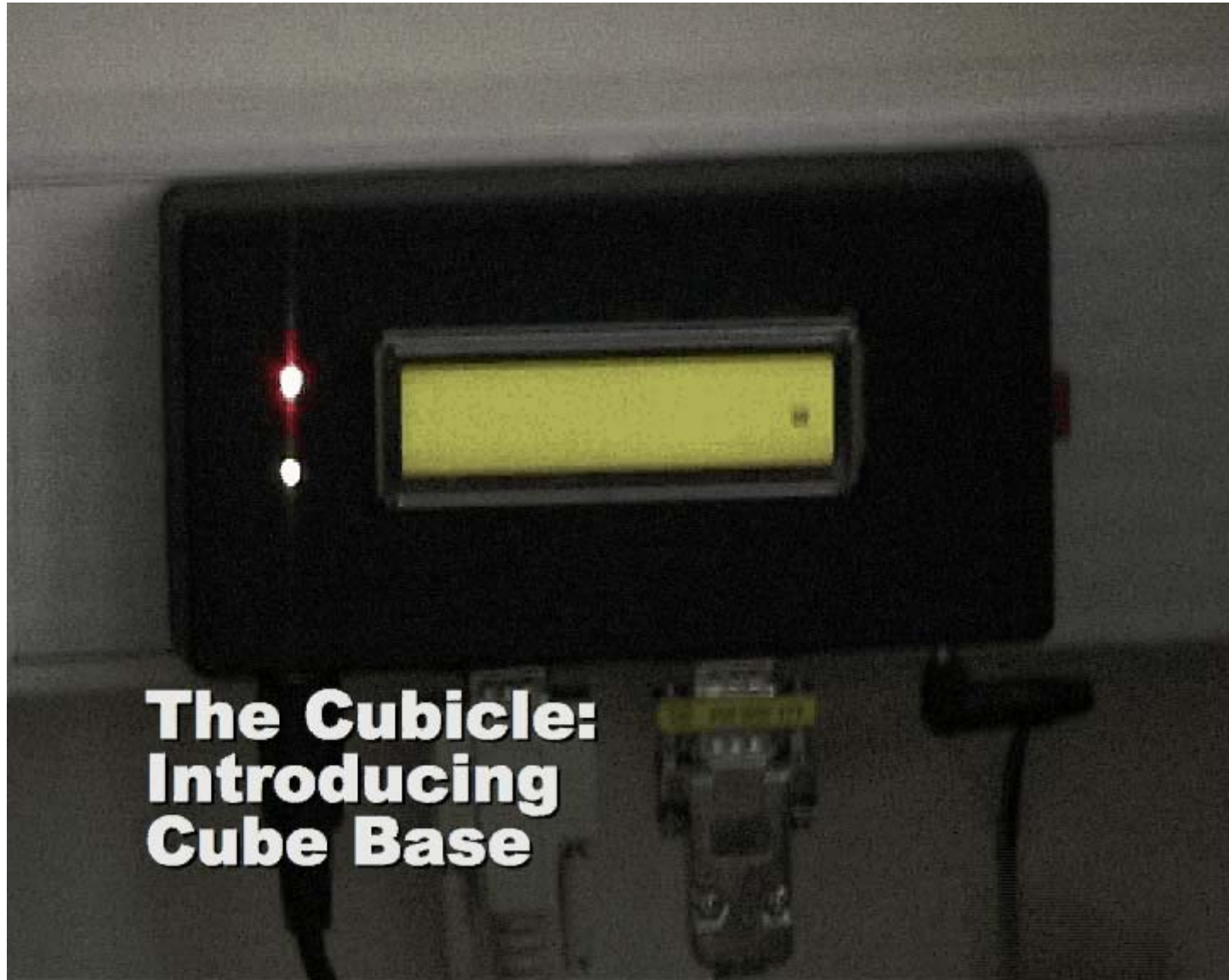
1. Top side?

- Gaussian:
$$G_i(\bar{x}) = \frac{1}{(2\pi)^2 \sqrt{|\Sigma_i|}} e^{-\frac{1}{2}(\bar{x} - \bar{\mu}_i)^T \Sigma_i^{-1} (\bar{x} - \bar{\mu}_i)}$$



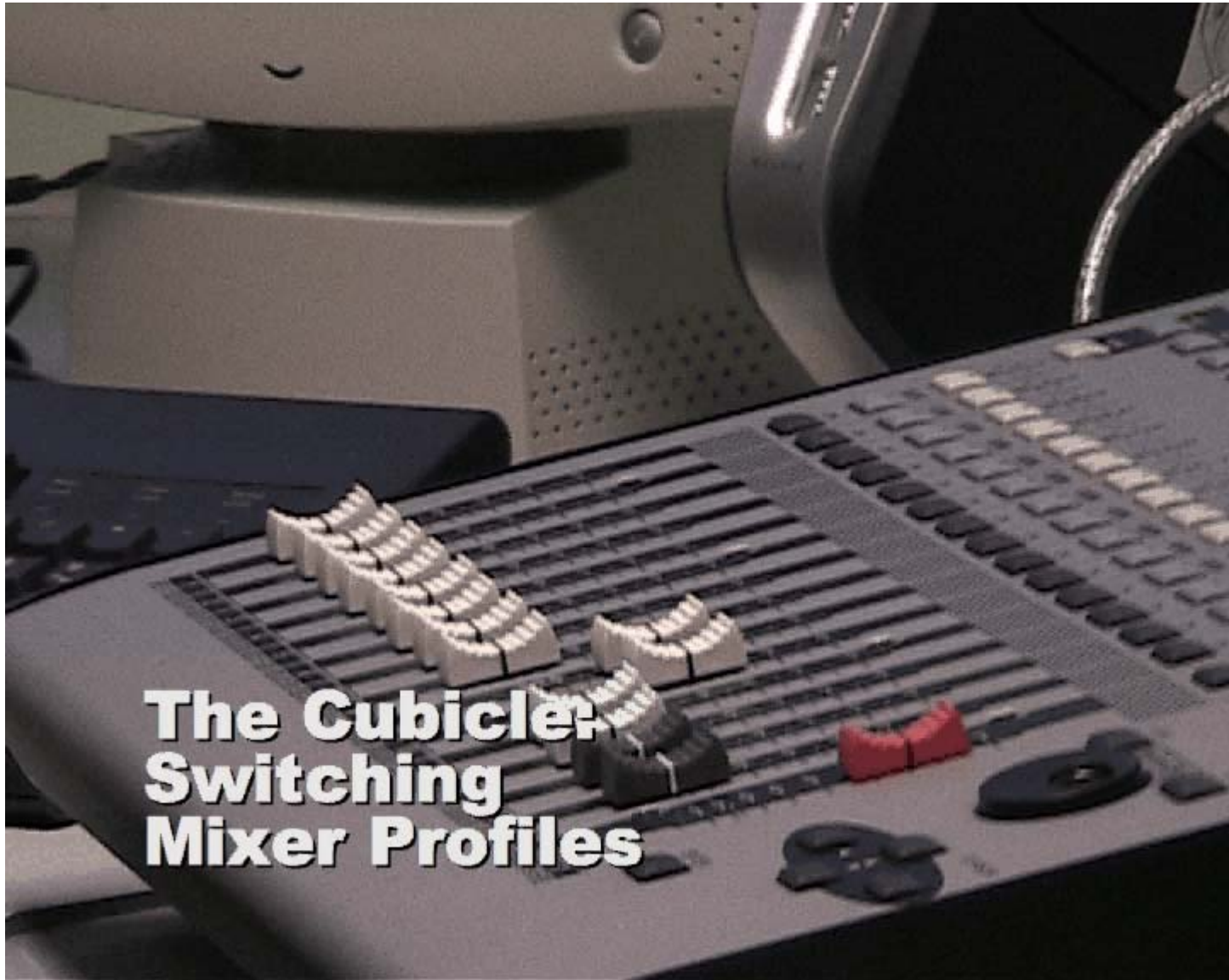
- Maximum Likelihood:
$$\arg \min_i \left((\bar{x} - \bar{\mu}_i)^T \Sigma_i^{-1} (\bar{x} - \bar{\mu}_i) + \ln |\Sigma_i| \right)$$

1. Example – Cube Base



**The Cubicle:
Introducing
Cube Base**

1. Example – Controlling Audio...

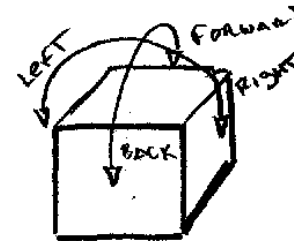
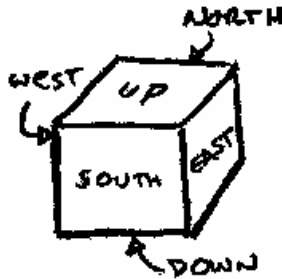


1. Example – ... and Video

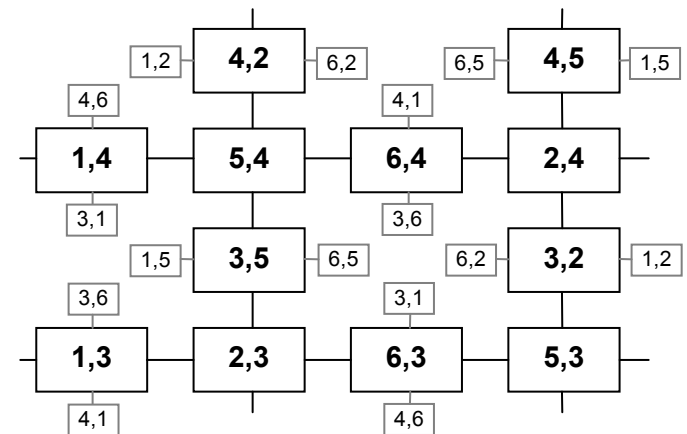
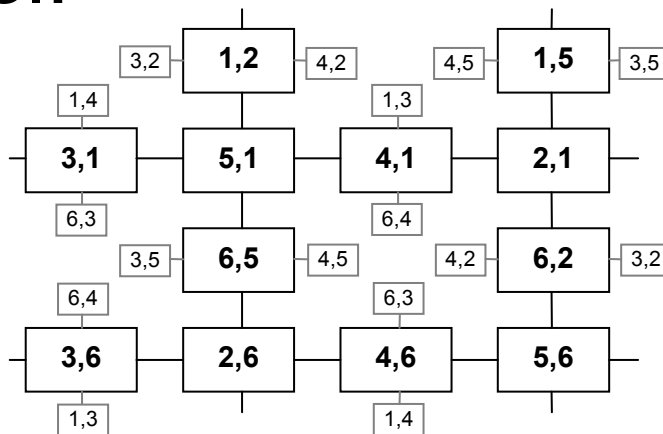


2. State Transitions?

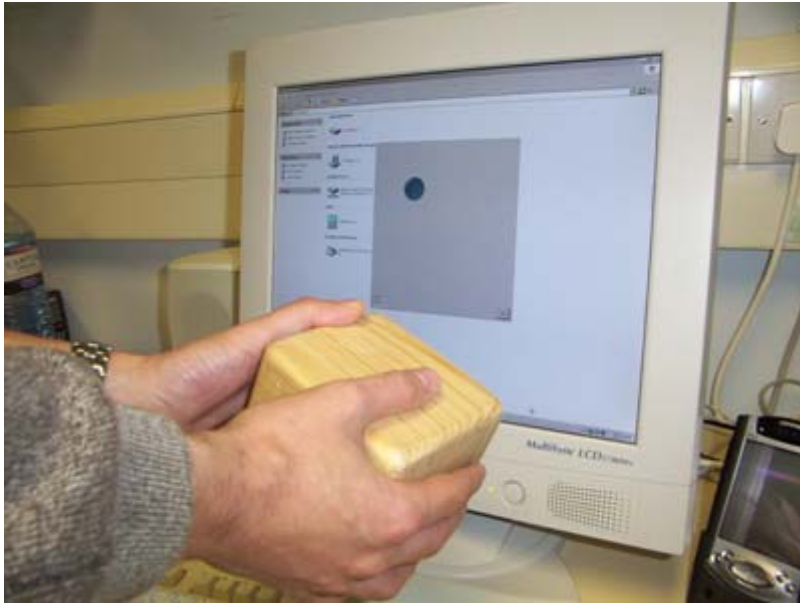
- State = (up,south), Transition=



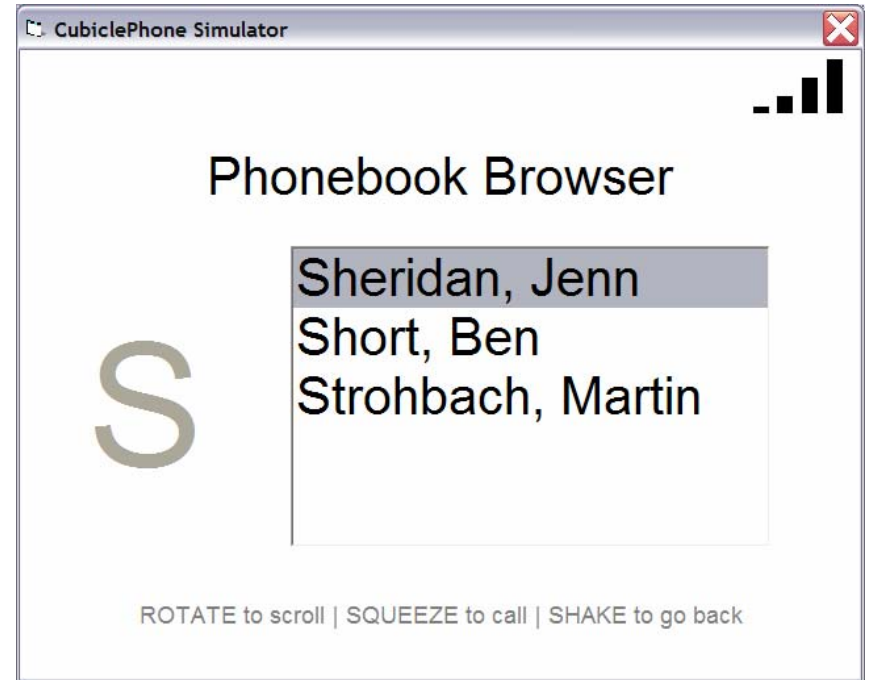
- Model:



2. Example



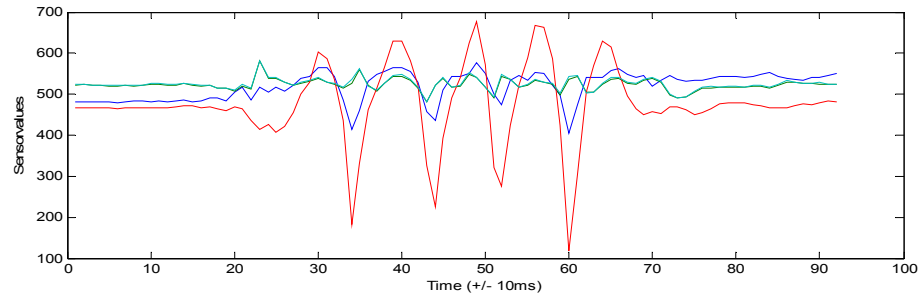
Moving a dot around the screen



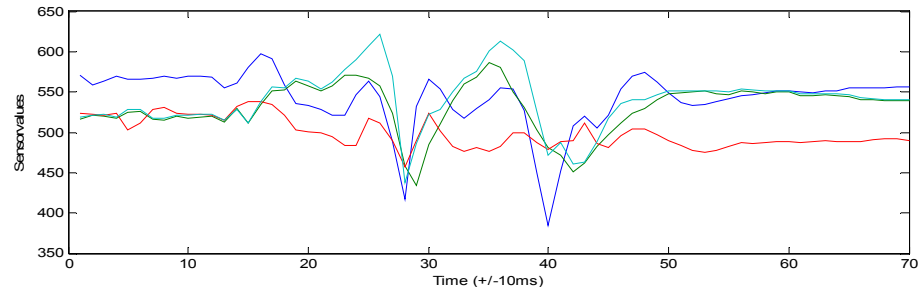
Navigating a mobile phone interface

3. Gestures

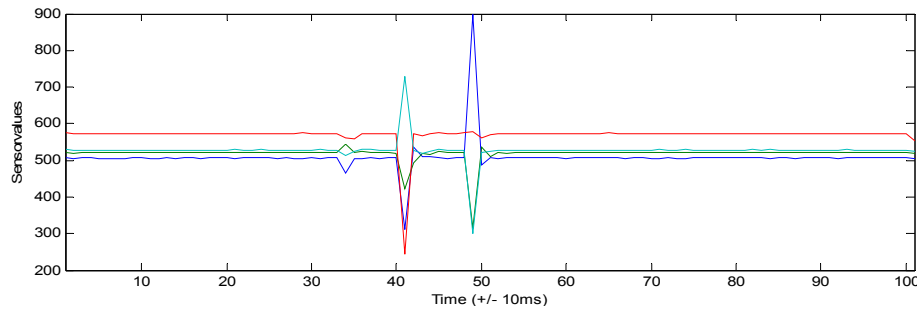
- Shaking



- Twisting



- Knocking



Conclusion

- Focusing on the microcontroller level
- Exploiting ambiguity in sensor signals:
- Goals :
 - making the signal processing better/easier
 - Getting the best of simple sensors
- More @:
<http://ubicomp.lancs.ac.uk>

